

Dear Editor,

First of all, thank you for the opportunity to improve the quality of our paper **“Development of a GIS tool for a high precision PV degradation monitoring and supervision: feasibility analysis in large and small PV plants”** (Manuscript reference **SUSTAINABILITY-191662**) and address most of the points raised in the review process. Please find below the list of changes made to the text and our responses to the reviewers’ comments. Moreover, English language and style have been revised in the full text.

Answers to Reviewer #1:

I.1- “This paper is tremendously improved. It is far easier to read and gets its point across much better as well.

Other than a few minor editing concerns (see listing below), I feel it is ready to go.

Line 19 (of the full mark-up) --- its (not the contraction it's).

Lines 87 -- results in (not results "of") -- Blue underlined by Word

Line 107 -- specifically (not "specially") -- Blue underlined by Word

Lines 446-447: should it be 11:00 to 13:00 of solar time (rather than 11 h to 13 h)?

Line 474 -- delete "that" -- Blue underlined by Word

Line 625 -- ", " before with (not a ".") -- Blue underlined by Word

Line 800 -- An analysis similar (rather than A "similar analysis") sounds better

Line 809 -- Not sure if "Actually" is necessary -- Blue underlined by Word

Lines 965-966 -- allowing future research to evaluate (deleting "in" and the unnecessary commas used to set off the phrase -- Blue underlined by Word

Line 977 -- especially (not "specially") -- Blue underlined by Word "

We are very grateful for this comment and the appreciation of the reviewer. We completely agree with the reviewer's comment and we have applied all suggested changes.

I.2- “Also, that appears to be the additional research discussed in the responses to the second reviewer. If so, you might want to provide a small bit (one or two sentences) which discuss the next piece of research (the second paper).”.

According to the reviewer suggestion, the following paragraph has been added to the text (lines 816 to 820):

“Moreover, thanks to this GIS tool, a deep analysis on the evolution of the behavior of the 108 kWp PV plant through time will be presented in future contributions. Both the faults location and the spatial distribution of the electrical parameters will be commented and the presence of correlations will be discussed. Based on this information, advanced preventive PV maintenance protocols will be suggested.”

Answers to Reviewer #2:

II.1- "As the authors suggest a spatial correlation is not detected in the data. Thus the GIS nature of the paper is not strongly supported. I still believe that in order to create such a database for a large facility high man power resources are required. Consider that each module must be disconnected in order to acquire one or more IV traces, IR images under certain angles to avoid artefacts, etc. This process will have a high cost if it is to be repeated on an annual basis. Otherwise it wouldn't help much. The overall work is more interesting from the point of view of the performance of a PV plant rather than from a GIS application."

By the moment, no references in the literature have been found supporting or retracting the hypothesis if PV faults have a spatial correlation. With this paper we aim to present a technique to study this issue in detail and arrange a conclusion on this topic. Although preliminary results show not strong spatial correlation, this is just a piece of the research and we find necessary to carry out more studies in order to check if degradation and faults occurrence have a spatial correlation with the PV field.

We completely agree with the reviewer in the appreciation that the proposed methodology may be cost-intensive in the human effort needed to supervise the whole installation with such precision. Nevertheless, this paper is intended to present the methodology and it has been applied to two case studies just with research purposes. Future research is intended to take advance of the obtained results and then, easier, more effective and costless techniques may be developed an applied.

II.2- "English proof reading is required. Sometimes it is difficult to follow a sentence."

Full text has been revised by a native English speaker and several English language and style corrections have been applied.

II.3- "Nowadays all inverters record information like Pmax, solar irradiance, temperature, DC, AC power etc. It is not difficult to create a tool on a string level as a first step to a GIS tool. The owner of a large system may not be interested in the type of problem but rather on its solution"

We agree with the reviewer that most inverters nowadays gather such information. However, we have not found any standards on this issue and the application of the GIS tool may help to do that. To our point of view, the GIS tool must be applied in a first step to develop and design the appropriate tools on a string level, as cleverly suggested by the reviewer.

II.4- "Use three significant figures in the Tables. Peak power and R_p values with 5 digits, V_{mpp} values with 4 digits indicate extremely high accuracy which is not the case."

As suggested by the reviewer, values in Tables only show three significant figures.

II.5- *“The authors may improve the paper by exploring the performance of the PV plants, especially the 108 kW one, in order to show the effects of the module failures. An intercomparison of the different strings may be shown and commented.”.*

We completely agree with the reviewer comment but we want to reinforce that the main target of the proposed manuscript is just to show the developed procedure and its application to two case studies. A deep analysis of the PV plants, including the intercomparison of the different strings as suggested, will be presented soon in a future contribution. Actually, the following paragraph has been added to the text (lines 816 to 820):

“Moreover, thanks to this GIS tool, a deep analysis on the evolution of the behavior of the 108 kWp PV plant through time will be presented in future contributions. Both the faults location and the spatial distribution of the electrical parameters will be commented and the presence of correlations will be discussed. Based on this information, advanced preventive PV maintenance protocols will be suggested.”

II.6- *“What would be the proposed actions in order to improve the performance of the PV plants now that measurements are available?”.*

Specific actions to improve the performance of the PV plants will be suggested with more detail in future contributions, where evolution through time of the PV plant behaviour will be studied and spatial correlations and spread evolution will be determined if exists. However, according to the reviewer suggestion, the following paragraph has been added to the text (lines 804 to 808) suggesting the main actions that must be taken into account:

“Furthermore, thanks to the available measurements, preliminary preventive maintenance actions can be carried out, such as the replacement of the damaged PV modules according to an abnormal presence of faults and/or a poor electrical behavior in the string, redistribution of the PV modules according to its performance and development of new specific supervision, cleaning and maintenance procedures for those modules affected by damaging PV faults, such as blue cells.”

All the authors want to express their sincere gratitude for all the valuable comments and contributions of the reviewers, as well as for their attention and dedication.

Yours sincerely,

The Authors.